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(54) **Method of renovating and/or protecting sewers or pipes.**

(57) A method for renovating or protecting sewers or pipes (10) of oviform or egg shape, where liner strip sections (20) are placed in a former (conforming to the sewer or pipe shape) and have their ends locked in mouth formations (16) along the sides of a base strip (12). At the position where the liner strip sections (20) are located, they are joined together by joiner strips (23) and the assembled liner is pulled through the sewer or pipe (10) by a winch connected to wires (14) embedded in the base strip (12). When positioned, the assembled liner is grouted into the sewer or pipe (10) with grout supplied via a grout pipe at the top of the cavity.

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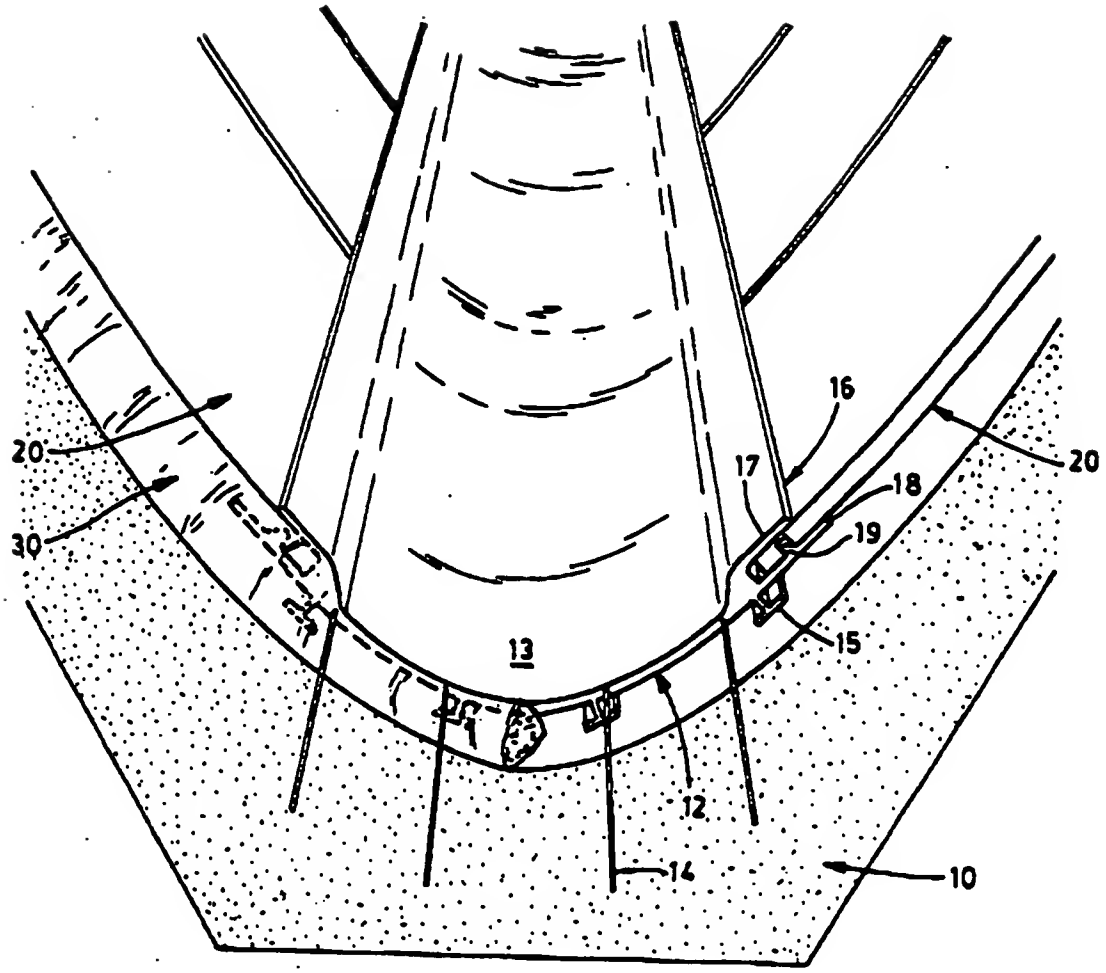

Fig. 2

This invention reletes to e method of renovating and/or protecting sewers or pipes.

EP85308548.8 (Patent No 0184366) (Danby Pty Ltd) discloses our "Twin Lok" method for relining non-man-entry sewers end pipes (eg. up to 900mm diameter), where the liner strip end joiner strip may be wound on the winding machine disclosed in EP88900062.6 (Denby Pty Ltd). The methods for relining larger man-entry sewers and pipes are disclosed in EP88901529.3 and 90307906.9 (both Denby Pty Ltd) for our "Penel Lok 2" end "Panel Lok 3" methods, respectively.

While these methods have proved very successful for the relining of annular (and large oval) sewers end pipes, they are not euitable for oval or egg-shaped sewers or pipes, which may be of men-entry size, but which incorporate e radius of curveture (eg. et the bese) of less than, eg. 600mm. This is because it is not possible to bend the semi-rigid UPVC liner and joiner strips through such e emall redius of curvature.

It is, therefore, an object of the present invention to provide e method for relining sewers end pipes of oval, egg-shape or similar shepes.

It is e preferred object that the liner be formed et one menhole in the sewer or pipe and be fed through the sewer or pipe to the next menhole.

It is e further object thet et least e portion of the liner be placed under tension (along the sewer or pipe) before the liner is grouted into position.

Other preferred objects will become apparent from the following description.

In one aspect, the present invention resides in e method of renoveting and/or protecting sewers or pipes, preferably of an oviform or egg-shape, including the steps of:

placing e former, conforming to the shepe of the sewer or pipe, et one end of e section of sewer or pipe to be lined;

placing an elongete base strip in the lower portion of the former, the base strip having respective mouth formations along each side;

placing liner etrip sections in the former, transverse to the base strip and engaging the ends of the liner strip sections in the mouth formations of the base strip;

locking the liner strip sections together;

edvencing the essembled liner into the sewer or pipe when et least one liner strip section is connected to the base strip; end

grouting the assembled liner into the sewer or pipe.

Preferably, the base strips are formed from semi-rigid PVC and mey be made in lengthe of, eg. 100 metres and suppiied on coils.

Preferably, the base strip hes one or more T-formations on the underside of its body; one or more wires embedded in, end extending along, its body; and the respective mouth formations include at least one tooth to engage the ends of the liner strip sections.

Preferably, the liner strip sections ere formed of semi-rigid UPVC, with T-formations directed outwardly on the body end inwardly directed joint formations along the side edges of the body. Preferably, the joint formations of two butted-together liner strip sections ere secured together by e joiner strip.

Preferably, the liner strip sections have e transverse groove or slot ecross the T-formations edjacent eech end of the sections, the grooves or slots engaging the respective teeth in the mouth formations of the bese etrip.

Preferably, the liner strip sections are preformed to the "horseshoe" shape, required to fit the sewer or pipe, by heating in a heeted liquid, eg. hot-water, beth.

Preferably, the wires in the bese strip are placed under tension before the essembled liner is grouted, to increese the strength of the bese strip.

The grout is preferebly pumped into the cavity between the liner end the sewer or pipe vie e grout pipe in the cavity, et the top thereof. The pipe may have a plurality of spaced grout holes which ere selectively opened by the movement of en outer sleeve ebout the grout pipe, the grout flowing down around the liner to fill the cavity.

In e second aepect, the present invention resides in an epparetus for renovating and/or protecting sewers or pipes, preferably of an oviform or egg shape, including:

e former, conforming to the ehepe of the sewer or pipe, located et one end of a section of sewer or pipe to be lined;

en elongete bese strip having respective mouth formetions elong each side to be pieced in the lower portion of the former;

liner strip sections with ends engegeable with the mouth formations of the bese strip, the liner strip sections being engageable in the former transverse to the base strip;

meens to lock edjacent liner strip sections together;

means to edvence the assembled liner into the eewer or pipe; end

means to grout the assembled liner into the sewer or pipe.

To eneble the invention to be fully understood, e preferred embodiment will now be described with reference to the eccompenying drawings, in which:

Fig 1 is an end view showing the essembled liner in the sewer or pipe;

Fig 2 is an end view of the base of the sewer or pipe end the liner;

Fig 3 is en enlarged scale view corresponding to Fig 2;

Figs 4 to 4B show the steps of engagement of the liner strip sections to the base strip;

Fig 5 is a sectional view taken on line 5-5 on Fig

1 of the assembled liner;

Fig 6 is e view corresponding to Fig 5 of using an alternetive liner strip profile and alternative joiner strip profile.

Referring to Fig 1, the sewer or pipe 10 is of generally egg-sheped form.

At one men-hole, e former (not shown) is aligned with the sewer or pipe, the former having en internel shape corresponding to, but just smaller than, the inner fece 11 of the sewer or pipe.

The base strip 12, extruded from e semi-rigid PVC, is drawn from a supply roll and pleced in the base of the former.

Referring now to figs 2 end 3, the base strip 12 has e curved (concave) body portion 13, in which are embedded four spaced wires 14. Four speced T-formetions 15 are formed integrally with the body portion 13. A mouth formation 16 is provided along each side of the base strip 12 end each mouth formetion 16 has inner end outer lips 17, 16 end en elongete tooth 19.

Liner strip sections 20, extruded from semi-rigid UPVC (eee Fig 5) heve body portions 21, termineted by inwardly directed joint formetions 32, with outwerdly directed T-formatione 23. As ehown in Fig 5, adjacent liner strip sections 20 are locked together by en extruded PVC joiner strip 23 with e peir of spaced legs 24 which engege the adjacent joint formetions 22. A groove or slot 25 is formed transversely ecross the ends of the liner strip sections through the T-formations 23.

Liner etrip sectione 20 ere pleced in e hot water beth and are preformed into e "horseshoe" shepe to metch the ehepe of the sewer or pipe 10.

The first liner strip 20 is placed in the former and its ends are engeged with the two mouth formetions 16 of the bese strip 12, ee shown in Figs 4 to 4B, where the teeth 19 are engeged in the slots 25. (If preferred, adhesive 26 may be provided in the mouth formetions 16 to secure/seal the ends of the liner strip eection 20 in the mouth formetions 16.) (The body 21 of the liner strip section 20 mey also be welded to the inner lips 17 of the mouth formatione 16, ee et 27.)

The next liner strip section 20 is pleced in the former, is butted egainst the first liner strip section end is engeged with the base strip 10.

The edjecent liner strip sections 20 are then locked together with a joiner strip 23 (see Fig 5).

The assembled liner is edvanced into the sewer or pipe 10 e distance (eg. 300mm) equal to the width of the base strip section 20, end the next liner strip section 20 is pleced in the former and secured to the base strip 12 and adjacent liner strip section 20. The liner essembly is egein edvanced end the next liner strip section is pleced in the former and assembled. The assembled liner mey be edvanced by pushing it and/or pulling it from the next manhole using e winch attached to the wires 14. When the assembled liner extends from one manhole to the next, the liner is grouted into position.

A grout pipe (not shown) is secured to the top of the inner face 11 of the sewer or pipe 10 before the essembled liner is installed. (This requires a workman to enter and move along the sewer or pipe to install the grout pipe.) The grout plpe mey have holes et, eg. 300mm centres elong its length and be surrounded by en outer sleeve, which can be withdrawn to selectively open the holes to allow the cementitious grout to flow into the cavity between the liner end the sewer well.

To increese the strength of the bese strip 12, the wires 14 are anchored at the starting manhole and ere tensioned by the winch et the next manhole end the interior of the liner mey be pressurized with water end/or eir.

The grout 30 is pumped along the grout plpe and is selectively allowed to fill the cavity ebout the liner.

The T-formations 15, 23 on the base strip 12 and liner strip sections 20 ensure thet the liner is securely enchored to the sewer or pipe 10. When the grout has set, thet section of the sewer or pipe may be re-connected to service.

As the base strip 12 is more flexible than the liner strip section 20, it can be easily formed to fit into sections of the sewer or plpe 10, usually at its bese, which heve small radii of curveture (eg. less then 600mm). Once the grout pipe has been installed, workmen ere not required to enter the sewer or pipe to install the liner, as this is effected et the manholes along the sewer or pipe.

Referring now to Fig 6, modified liner strip sections 120 heve inwardly-directed joint formetions 122, which heve a serrated elde wall 122e end e eupport foot 122b. The modified joiner strips 123 heve speced legs 124 with serrations 124e which engege the serrated slde walls 122e of the edjacent liner strip sections 120.

Glue or adhesive 126 may be laid in a bead in the base of the joint formations 122 to seal end lock the legs 124 into the joint formetione.

In eddition to oviform end egg-shaped sewers or pipes, the present method mey be used in horseshoe with the cunette sewers or pipes, or rectangular sewers or pipes, when the base strip 12 is configured to conform with the bottom portion of the sewer or pipe wall.

The present invention provides a simple, yet effective method, for relining such sewers and the skilled eddressee will quickly eppreciete its edvantages over the known method, which require the use of preformed, rigid fibreglass panels being pleced in the sewer or plpe and locked together, menuelly.

Varioue chenges end modifications mey be mede to the embodiments described and illustrated.

Claims

1. A method of renovating and/or protecting sewers or pipes, preferably of an oviform or egg-shape, including the steps of:

placing a former, conforming to the shape of the sewer or pipe, at one end of a section of sewer or pipe to be lined;

placing an elongate base strip in the lower portion of the former, the base strip having respective mouth formations along each side;

placing liner strip sections in the former, transverse to the base strip and engaging the ends of the liner strip sections in the mouth formations of the base strip;

locking the liner strip sections together;

advancing the assembled liner into the sewer or pipe when at least one liner strip section is connected to the base strip; and

grouting the assembled liner into the sewer or pipe.

2. A method according to Claim 1 wherein:

the base strips are formed from semi-rigid PVC with one or more T-formations on the underside of its body;

one or more wires embedded in, and extending along, its body; and

the respective mouth formations include at least one tooth to engage the ends of the liner strip formations.

3. A method according to Claim 1 or Claim 2 wherein:

the liner strip sections are formed from semi-rigid PVC, each liner strip section having T-formations directed outwardly on the body and inwardly directed joint formations along the side edges of the body.

4. A method according to Claim 3 wherein:

the joint formations of two butted-together liner strip sections are locked together by a joiner strip.

5. A method according to Claim 3 wherein:

each liner strip section further includes a transverse groove or slot across the T-formations adjacent the ends of the sections, the grooves or slots engaging the respective teeth in the mouth formations of the base strip.

6. A method according to any one of Claims 1 to 5 wherein:

the liner strip sections are pre-formed to the shape of the former by heating in a hot-liquid bath.

7. A method according to Claim 2 wherein:

the wires in the base strip are connected to a winch at the other end of the section of sewer or pipe, the winch hauling the assembled liner to advance it into the sewer or pipe.

8. A method according to Claim 2 wherein:

the wires in the base strip are placed under tension, before the assembled liner is grouted, to increase the strength of the base strip; and

the interior of the assembled liner is pressurised with air and/or water to increase the strength of the liner strip sections as the assembled liner is grouted in the sewer or pipe.

9. A method according to any one of claims 1 to 8 wherein:

the grout is pumped into the cavity between the assembled liner and the sewer or pipe via a grout pipe at the top of the cavity.

10. A method according to Claim 9 wherein:

the grout pipe has a plurality of spaced grout holes which are selectively opened by the movement of an outer sleeve along the grout pipe, the grout flowing down around the assembled liner to fill the cavity.

11. Apparatus for renovating and/or protecting sewers or pipes, preferably of an oviform or egg shape, including:

a former, conforming to the shape of the sewer or pipe, located at one end of a section of sewer or pipe to be lined;

an elongate base strip having respective mouth formations along each side to be placed in the lower portion of the former;

liner strip sections with ends engageable with the mouth formations of the base strip, the liner strip sections being engageable in the former transverse to the base strip;

means to lock adjacent liner strip sections together;

means to advance the assembled liner into the sewer or pipe; and

means to grout the assembled liner into the sewer or pipe.

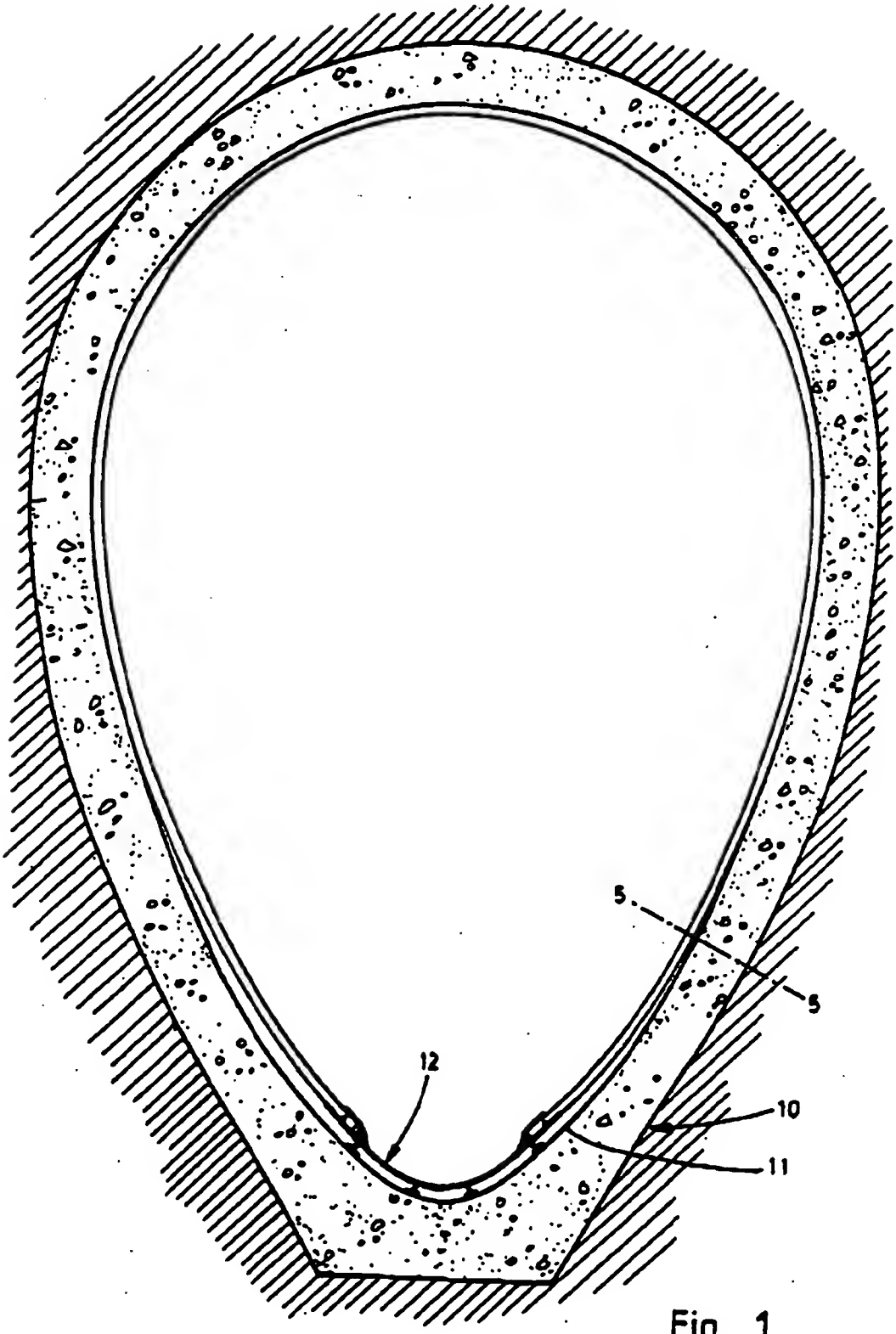

Fig. 1

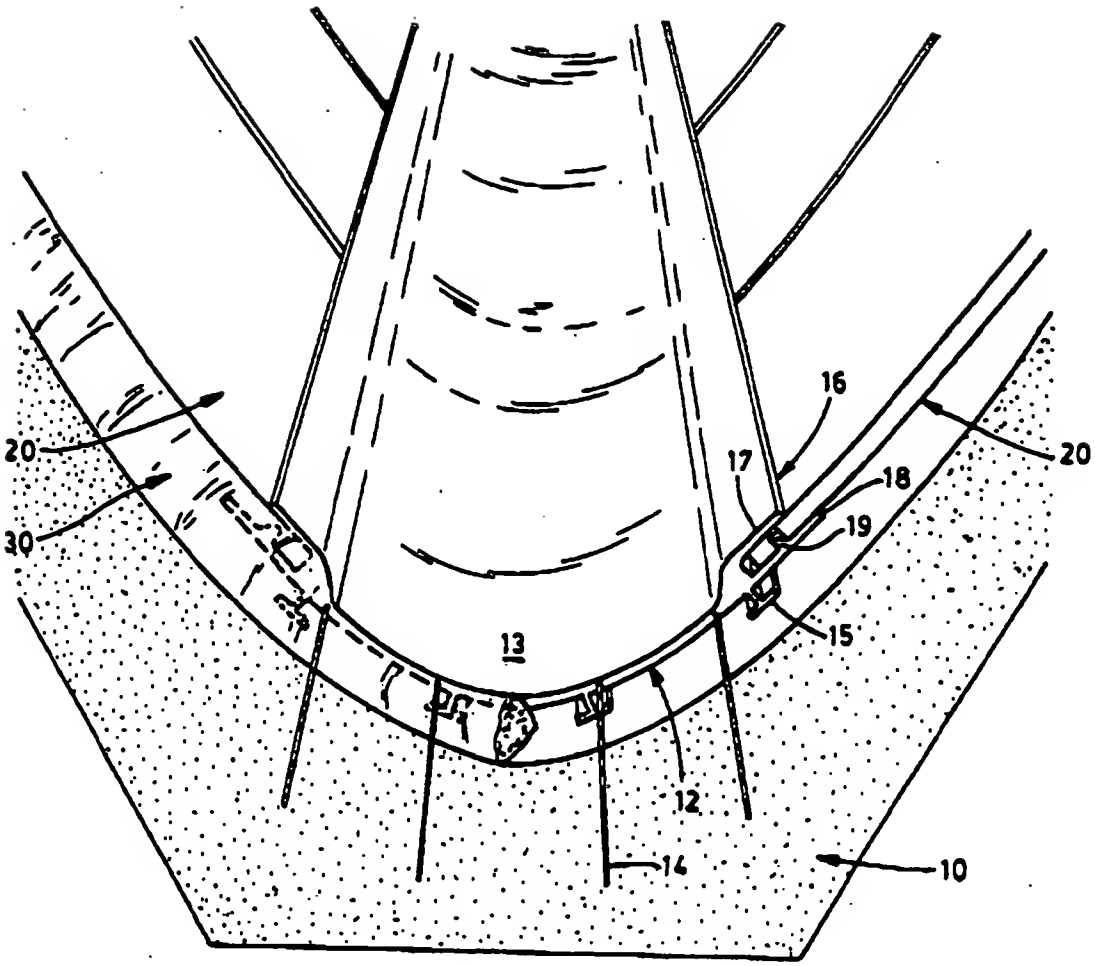

Fig. 2

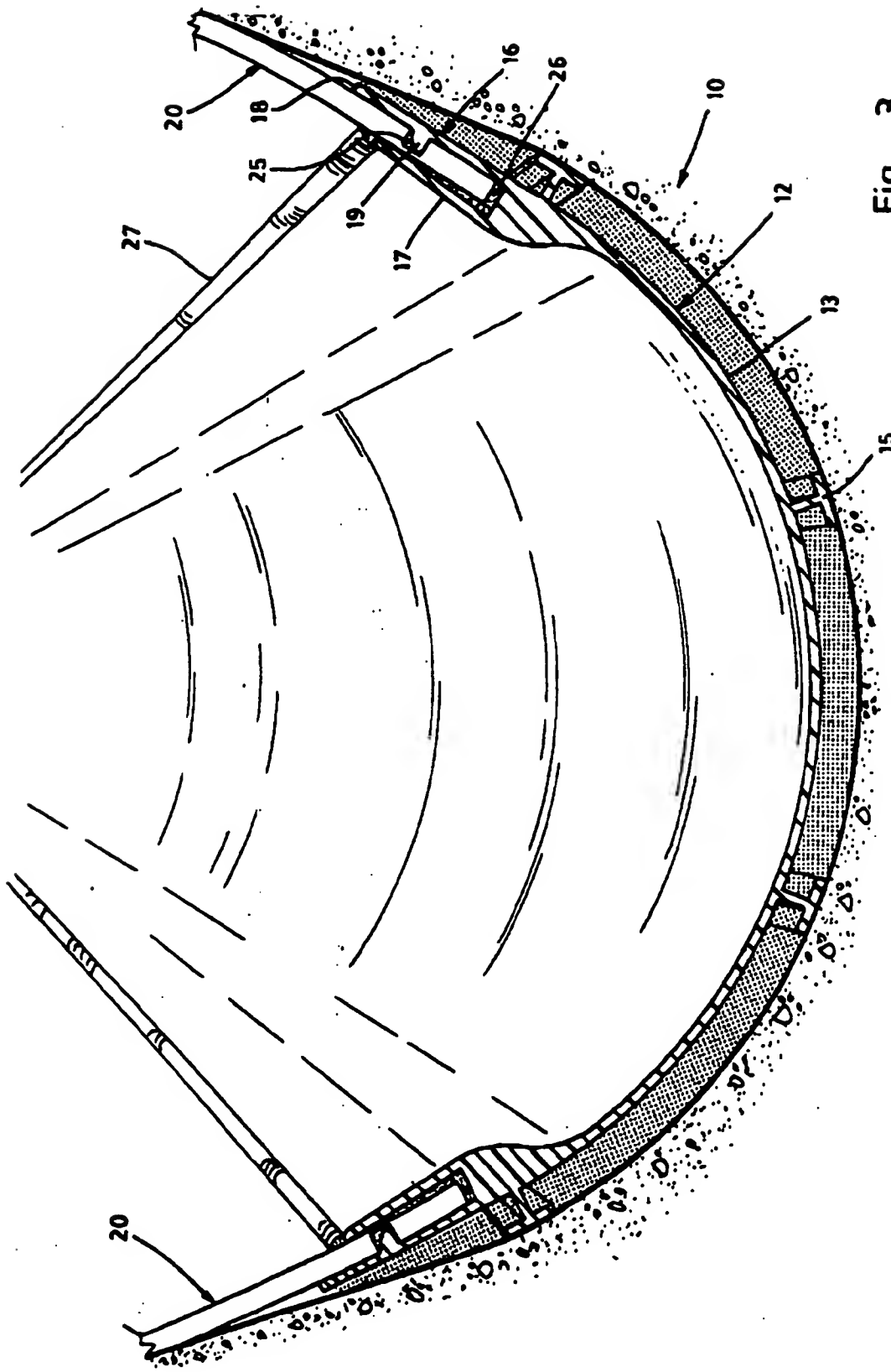

Fig. 3

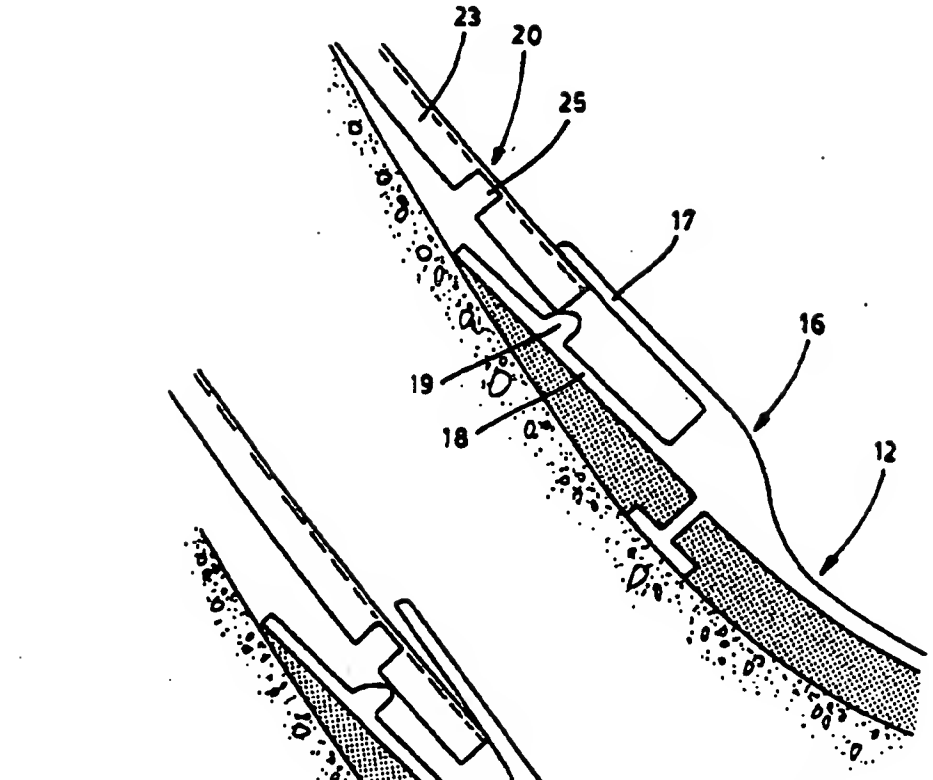

Fig. 4

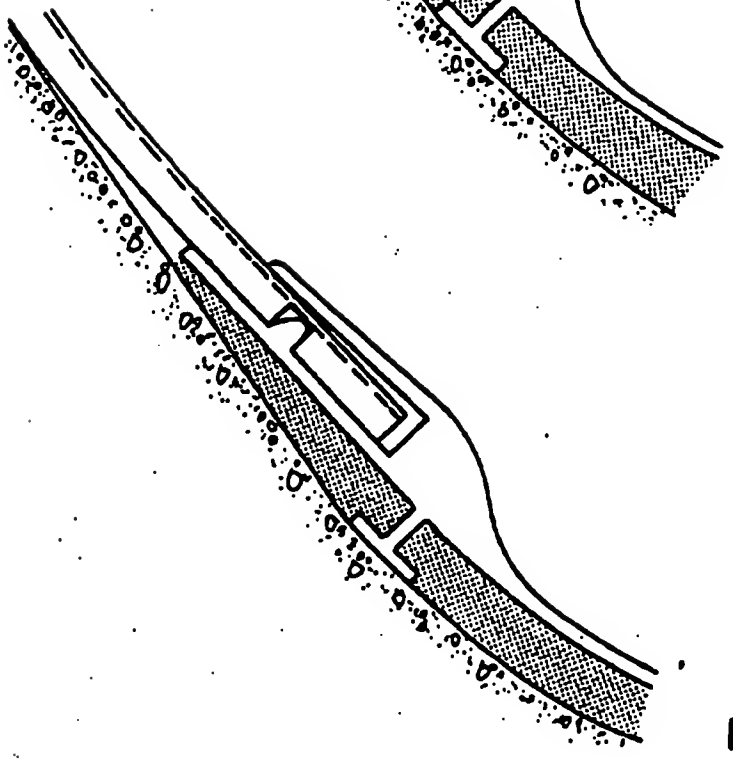

Fig. 4A

Fig. 4B

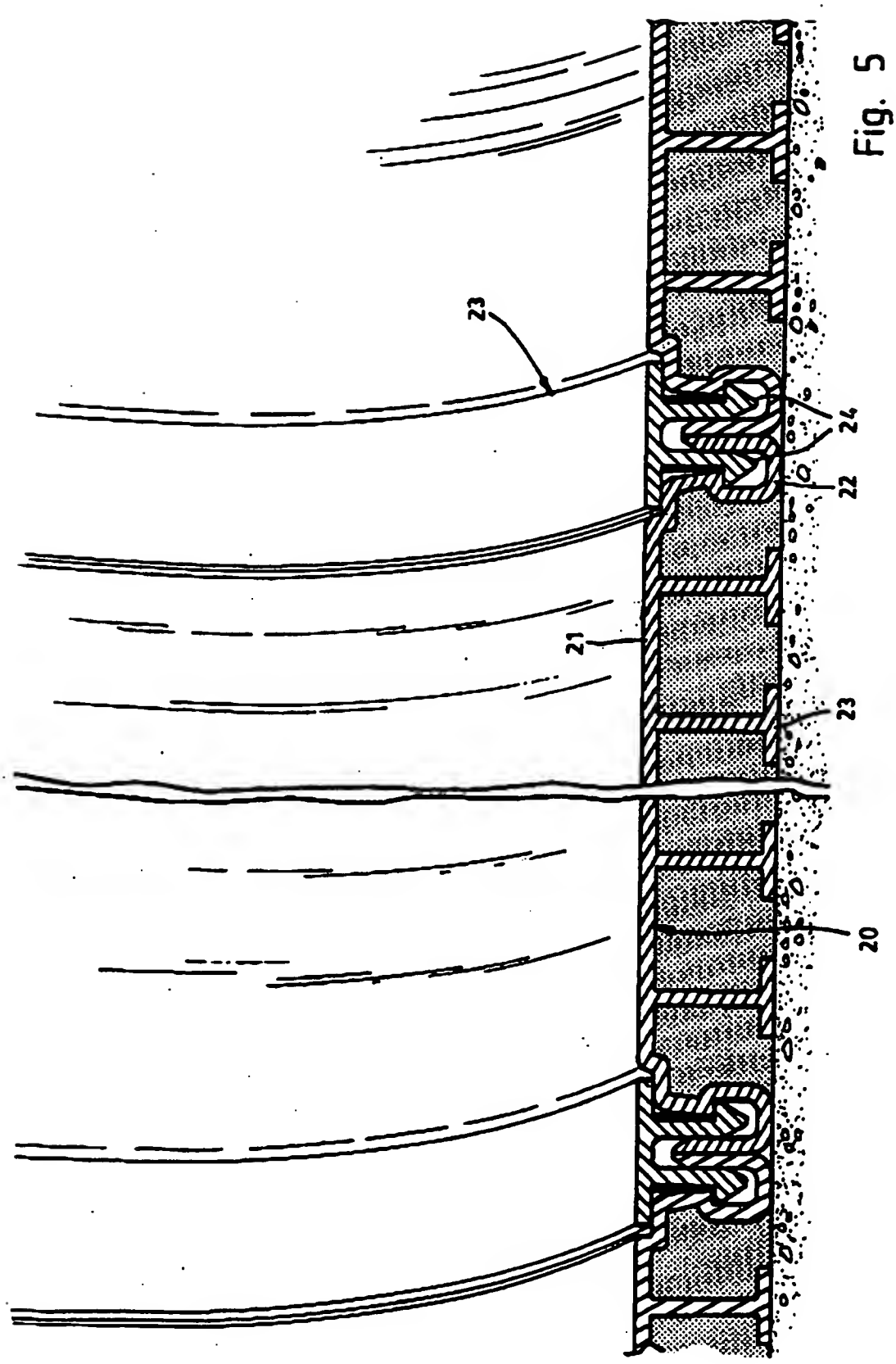

Fig. 5

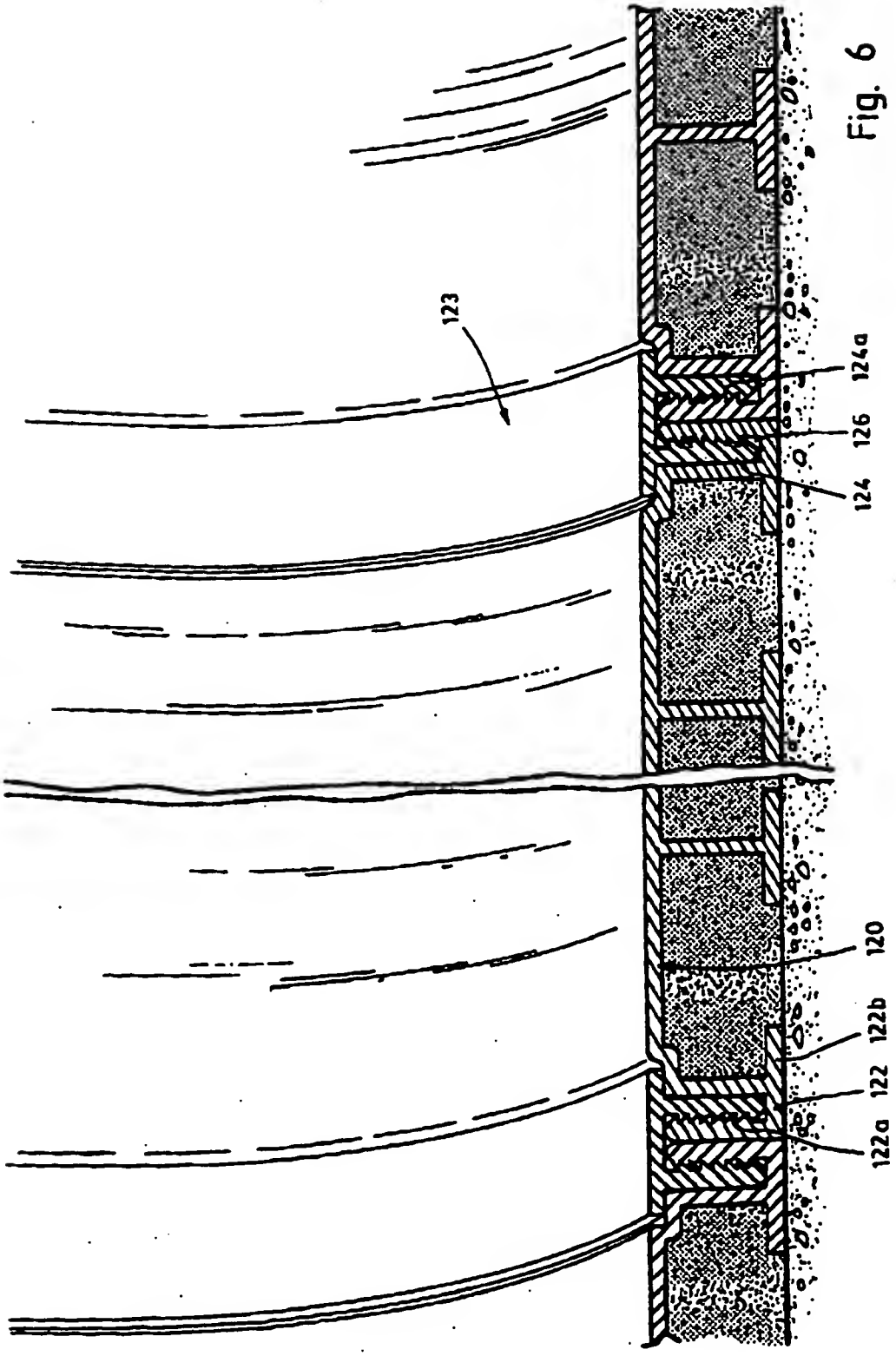

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 8352

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-3 700 883 (BONEX) * column 12, line 58 - column 13, line 60 * * column 15, line 51 - column 16, line 27; figures 4,5,6 *	1,11	E03F3/06 F16L55/165 F16L58/10
Y		3,4,9	
O,Y	WO-A-8 805 884 (DANBY) * page 3, line 19 - page 4; figures 2,3,4 *	3,4	
A		2	
A	DE-A-3 418 605 (P. HEIDENREICH) * page 11, line 9 - line 11; figure 5 *	2	
Y	GB-A-2 079 805 (OEMCO) * page 1, line 97 - page 2, line 27; figure 4 *	9	
A		8	
A	WO-A-8 803 598 (DANBY)	-	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5) E03F F16L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 DECEMBER 1991	KRIEKOUKIS S.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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